National Transportation Safety Board
Washington, DC 20594

Brief of Accident

Adopted 11/29/2007

CHI05MA011
File No. 22316 | 10/20/2004 | Lake Michigan | Aircraft Reg No. N709CK | Time (Local): 20:29 CDT

Make/Model:	Boeing / 747-132
Engine Make/Model:	Pratt & Whitney / JT9D-7A
Aircraft Damage:	Substantial
Number of Engines:	4
Operating Certificate(s):	Flag Carrier/Domestic
Name of Carrier:	Kalitta Air, LLC
Type of Flight Operation:	Non-scheduled; International; Cargo
Reg. Flight Conducted Under:	Part 121: Air Carrier

	Fatal	Serious	Minor/None
Crew	0	0	5
Pass	0	0	0

Last Depart. Point:	CHICAGO, IL
Destination:	NEW YORK, NY
Airport Proximity:	Off Airport/Airstrip

Condition of Light:	Night
Weather Info Src:	Weather Observation Facility
Basic Weather:	Visual Conditions
Lowest Ceiling:	1700 Ft. AGL, Overcast
Visibility:	10.00 SM
Wind Dir/Speed:	
Temperature (°C):	11
Precip/Obscuration:	No Obscuration; No Precipitation

Pilot-in-Command Age: 45

Certificate(s)/Rating(s)
Airline Transport; Commercial; Multi-engine Land

Instrument Ratings

Flight Time (Hours)

Total All Aircraft:	10015
Last 90 Days:	180
Total Make/Model:	4000
Total Instrument Time:	UnK/Nr

The Boeing 747-132, operated as an unscheduled domestic cargo flight under 14 CFR Part 121, was climbing through 15,000 feet mean sea level when the number one engine separated from its forward and aft engine mounts resulting in substantial damage to the airplane. The flight diverted to an alternate airport where it landed without further incident. Examination of the engine revealed an uncontained separation of an approximately 180-degree arc of the second stage turbine disk rim. The missing section of the rim coincided with circumferential rub marks on the second stage turbine disk that corresponded to rub marks on the rear inner rails of the second stage turbine vanes. The rubbed areas of the disk and vanes did not exhibit heat cracking consistent with a relatively long time period of rubbing relative to a sudden disk-to-vane contact. The fan rotor bearing did not exhibit rotational distress. The engine did not exhibit any evidence of a blade separation, case rupture, or any other uncontainment. The second stage retaining bolts are coated with a baked-on antiseize compound, FelPro C-200, during manufacture. Metallurgical exam of the second stage turbine bolts revealed cracking in the head-to-shank fillet radius and the presence of silver consistent with Silver Goop. Silver Goop is an anti-seize compound not authorized by the engine manufacturer for use in the high-pressure turbine area but is authorized in the low-pressure compressor area due to the catalytic properties of silver with wet FelPro C-200 resulting in a corrosive mixture that can contribute to bolt fractures. The induced loads from the second stage disk rim separation were estimated to have been 3.6 - 6.6 times greater than to those induced by a fan blade separation. The accident operator purchased an engine as-is and that according to maintenance records was not preserved when it was removed from an airplane belonging to another operator about 5 years prior to the accident. The high-pressure turbine (HPT) module was removed from this engine and installed on one of the accident operator's other engines prior to it being removed and then installed on the accident airplane engine. The accident operator's examination of the HPT was limited to a visual inspection that would

not have detected a vane shift or ascertained the integrity second stage turbine vane assembly.

CHI05MA011
File No. 22316 | 10/20/2004 | Lake Michigan | Aircraft Reg No. N709CK | Time (Local): 20:29 CDT

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: CLIMB

Findings
1. (C) TURBINE ASSEMBLY,TURBINE WHEEL - SEPARATION
2. (C) MAINTENANCE - IMPROPER - UNKNOWN
3. (C) MAINTENANCE,INSPECTION - INADEQUATE - COMPANY MAINTENANCE PERSONNEL

Occurrence #2: IN FLIGHT COLLISION WITH OBJECT
Phase of Operation: CLIMB

Findings
4. (C) OBJECT - OTHER

Findings Legend: (C) = Cause, (F) = Factor

The National Transportation Safety Board determines the probable cause(s) of this accident as follows.
The number one engine separated from the airplane during climb due to the uncontained separation of a portion of the second stage turbine disk rim after the second stage turbine vanes contacted the disk. The second stage turbine vanes contacted the second stage turbine disk due to the operator's inadequate inspection of the high pressure turbine module and the improper repair of the module by unknown maintenance personnel.